ERGIS Technical Review Committee Meeting: June 19, 2013, Washington, D.C.

The purpose of this meeting was to review action items from the working group meetings, discuss initial modeling results, and review transmission and mitigation assumptions and methods for the study.

Review of Model and Study Overview

NREL presented the TRC with a general overview of the project and highlighted the addition of a new scenario that was being added to the study. NREL developed a No-RPS Reference scenario to add to the existing RPS case, 30% national, and 30% regional scenarios. This new scenario will be used to capture impact of the initial penetration of wind and solar into the power system.

The topic of bilateral agreements was brought up. The TRC discussed the impact of bilateral contracts on our study approach and agreed that, in an ideal world, data about bilateral contracts would be studied. However, there is no ability to obtain data about bilateral contracts. Furthermore, since most of the Eastern Interconnection uses a security constrained unit commitment and 5 minute economic dispatch, and bilateral agreements are driven by market forces, the TRC agreed that it is reasonable to model all units as economically dispatched.

Generation Working Group Recap

The operating characteristics of the hydro fleet in the eastern interconnection were discussed. DOE staff provided NREL with contacts at several of the power administrations to obtain data necessary to validate NREL's economic dispatch assumption for Plexos modeling

The TRC also discussed the aggregation of plants with multiple units and a combined capacity of < 120 MW. The TRC discussed the modeling of outages and NREL explained that partial outages of aggregated units are allowed.

NREL reviewed results from its retirement analysis and thermal expansion runs in ReEDS. The TRC reviewed generator retirements for each of the RTO/NERC regions and agreed that the initial estimates used by NREL were too low. Numerous stakeholders provided links and contact information to update NREL's retirement assumptions. The TRC argued for reflecting EPA regulations on our retirement estimates. Contacts were made at DOE Fossil to provide their retirement analyses.

The TRC also discussed the operating characteristics of new thermal additions for the study. The TRC discussed whether new units should have the same flexibility (minimum generation levels and ramp rates) as existing units. The TRC agreed to model units with current operational characteristics. This approach avoids skewing results by assuming a flexible thermal generation fleet. If all additions to the

system are more flexible than the current fleet, the study might miss critical insights into the needs for the future system.

NREL Action Items:

- NREL will contact the PMAs to validate hydro assumptions
- NREL will review retirement data from all study regions and repeat the ReEDS capacity expansion analysis
- NREL will host at least one Generation Working Group call to discuss refinements to the retirement assumptions and the results of additional ReEDS runs

Canadian System Working Group Recap

The TRC discussed the modeling assumptions for the Canadian system. There was general agreement in our modeling approach and data for IESO and Manitoba Hydro. There were several questions about load assumptions for the Canadian system. Rob Sinclair from the IESO provided additional details on Ontario's long term energy plan and updated solar profiles. Questions were asked about plants for hydro and transmission expansion in Manitoba. David Jacobson from Manitoba Hydro followed up after the meeting with details on new plants and transmission that should be considered for the Manitoba Hydro system. NREL is still looking for assistance on modeling Hydro Quebec. NREL has found some data for proxy generators for HQ, however there are several non-trivial upgrade and expansion plans that should be considered.

NREL Action Items:

- NREL will obtain necessary links for Ontario solar profiles from Rob Sinclair
- NREL will add the necessary Manitoba Hydro plant and transmission expansions to the model
- NREL will continue to develop the Hydro Quebec modeling plans

EI Model Update

The TRC reviewed PLEXOS modeling results for initial modeling runs. NREL's initial model was an hourly day-ahead regional analysis that included one ancillary service. The model took 12 days to solve the full 2010 year. The TRC reviewed flow data from the simulations and encouraged NREL to review interchange assumptions. Several of the generation mixes for 2010 did not fit with historical and

industry knowledge and the interchange limits appeared to be a possible explanation. There were also suggestions to separate MISO into US and Canadian portions.

The TRC requested more analysis of 2010 before moving to the ERGIS study year. The addition of hurdle rates and analysis of historical flows and regional generation by fuel type were recommended. The TRC also discussed whether emissions needed to be modeled as a driver in plant output. DOE Fossil will be contacted to better understand the impact of emissions controls and regulations.

The TRC was disappointed in the long solve time for the initial analysis. Many members were surprised at the run time for the model, given that the transmission system had been simplified so much. When discussing potential sensitivity analysis the TRC agreed it may not be practical to analyze all time intervals for each scenario. Therefore, to the extent practicable, NREL will identify key study periods for sensitivities (for example, the summer peak, and wind peak).

NREL Action Items:

- NREL will run additional analysis on 2010 model year
- NREL will study interchange and the use of hurdle rates to align historical and modeled results.

Transmission Working Group

NREL proposed to use the EIPC transmission expansions used in the EIPC production cost simulations for ERGIS. There was discussion of the difference in study years between ERGIS and EIPC. ERGIS is planned to study 2020 and EIPC studied 2030. The TRC discussed several intermingled concerns. While the year differs between the studies, the load assumptions may not be that different. EIPC had very limited load growth in its Scenario 1 (which had the largest transmission build-out). Michael Goggin of AWEA suggested that the biggest transmission expansion from EIPC was going to have very high curtailment rates and that we would need to expand the system even more. Dave Whiteley of the EIPC explained that they are currently developing two new load cases for 2018 and 2023 and suggested one of these load cases could be used for ERGIS. Aaron Townsend of NREL explained that the work necessary to convert a new load-flow case to PLEXOS could be done but was not a trivial task. After significant discussion, the group agreed that the EIPC transmission build-outs are a reasonable starting point and that we will have to look at curtailments and other operational impacts after initial runs are completed in order to see whether additional transmission expansion is necessary.

The TRC also discussed approaches to modeling the Eastern Interconnection zonally. Participants agreed that RTO-sub zones should be identified to reflect intra-regional constraints and to provide a more detailed resolution of the transmission system. Several individuals suggested reviewing a recent MISO LOLE study for local resource zones in MISO. Existing capacity zones could be considered for each of the RTOs.

Lastly, the TRC discussed the schedule for transmission working group meetings. The TRC agreed there will need to be at least 2 working group meetings in the next quarter and potentially more.

NREL Action Items:

- NREL will evaluate existing zones within the RTOs and propose them for discussion at the first working group meeting.
- The study will focus on the assumptions for the study and not on the study year.
- NREL will use the EIPC transmission expansion.
- NREL will hold two transmission working group conference calls.

Mitigation Options Working Group

The TRC discussed the difference between sensitivities and mitigation options. They group also discussed the need to see initial modeling results before deciding which sensitivities and mitigation options should be pursued. NREL proposed having mitigation options working group meetings between July and September, but the TRC suggested that NREL delay the mitigations working group meetings until the baseline results are available.

The TRC expressed that they wanted to have a better understanding of the problems that might need to be mitigated and what options could be used after looking at initial results. Jay Morrison of NRECA suggested that a few principles guide our selection of mitigation options. First, he suggested that ERGIS consider at the total costs of implementing each mitigation option, including capital costs. Second, he suggested that the mitigation options that are most practical should be studied first. Also, the current configuration of system operations should be reflected in the initial runs. This means that, to the extent practicable, regions should be optimized internally, but not with the rest of the interconnection.

NREL Action Items:

- NREL will host one working group call at the end of the quarter to discuss preliminary modeling results and potential mitigation options.

3-Month Plan

NREL will host at least one Generation Working Group call to discuss refinements to the retirement assumptions and the results of additional ReEDS runs.

NREL will host a Transmission Working Group Call in July.

NREL will host a Mitigation Options Working Group Call in late August or September.

The next TRC meeting will take place in early November in Washington DC. NREL will focus on finding a meeting time November 4-8 or 12-15. November 11 is a Federal holiday.

Meeting Participants

Jared Alholinna	GR Energy
Mike Casper	NRECA
David Whitely	EIPC
Gary Jordan	NREL Contractor
Jack King	NREL Contractor
Stan Hadley	ORNL
Sundar Venkataraman	GE
Charlie Smith	UVIG
David Jacobson	Manitoba Hydro
Robert Sinclair	Ontario Power Authority
Aaron Townsend	NREL
Aidan Tuohy	EPRI
Jean-Paul Watson	Sandia
Venkat Banunarayanan	DOE
Larry Mansuetti	DOE
Charlton Clark	DOE
Kevin Lynn	DOE
Doug Middleton	DOE
Jon Worthington	DOE
Tony Ingram	EEI
Aaron Townsend	NREL
Ken Schuyler	PJM
Michael Goggin	AWEA
Kevin Thundiyil	Exelon
Clayton Barrows	NREL
Jason Schmidt	Ventyx
Jay Caspary	SPP
Mitchel Williams	Western Farmers
Tom Schneider	NREL
Steve Theil	Com Ed
Matt Schuerger	Energy Systems Consulting Services
Mark Ahlstrom	WindLogics

Eric Krall	FERC
Becky Robinson	FERC
Jay Morrison	NRECA